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| **SCH4U – Chemical Systems and Equilibrium**  Determining Ksp for Calcium Hydroxide | | **Teachers:** Ms. Laura Sardone, Ms. Aleksa Brkic, Mr. Jeremy Burt, Mr. Michael Law  **Time:** 75mins | | |
| **Materials:**   * 500mL 0.1M HCl * 500mL saturated Ca(OH)2 * 50mL phenolphthalein indicator * 500mL distilled H2O * 6 thermometers * 6-8 plastic transfer pipettes * 6 6-well plates * Toothpicks, ice, sand, hotplates | | **Appendix**  I. Solubility Lab Handout including Rubric | | |
| **Curriculum Connections:**  **Big Idea:**  Chemical systems are dynamic and respond to changing conditions in predictable ways  **Overall Expectations:**  A1 Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analyzing and interpreting, and communicating)  E2. investigate the qualitative and quantitative nature of chemical systems at equilibrium, and solve related problems  E3 Demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause shifts in the equilibrium of chemical systems.  **Specific Expectations:**  A1.1 Formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research  A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory materials; and by using appropriate personal protection (e.g., wearing safety goggles)  A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data  A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including tables, flow charts, graphs, and/or diagrams  A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI units, imperial units)  A1.13 Express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places and significant figures  **Learning Goals:**  By the end of the lesson, students will be able to conduct a downscaled acid-base titration and an inquiry to determine the value of an equilibrium constant for a chemical reaction.  **Prior Knowledge:**  SCH3U – C: Chemical Reactions, D: Quantities in Chemical Reactions, E: Solutions and Solubility | | | | |
|  | **T/L Strategy** | | **Rationale** | **Assessment** |
| **Minds On**  (15mins)  (5mins)  (5mins) | **Whole Class 🡪 Brainstorm**   * Class divided into groups of 4-5 * Each group brainstorms answers to pre-lab while teacher checks for completion * Each group orally presents selected pre-lab questions without repeating   **Teacher 🡪 Mini-Lecture**   * Point out dangers associated with each chemical (MSDS related information), proper disposal method, and general safety information   **Teacher 🡪 Model Lab**   * Demonstrate lab to students including how to set up ice water bath and sand bath | | * Assess prior knowledge and readiness * Lack of overlap ensures students are listening and focused * Activates prior knowledge * Scaffold lab via modelling | **AfL**  Listen to student responses  **AfL**  See if students have any questions |
| **Action**  (35mins) | **Whole Class 🡪 Lab**   * Members of groups given roles (time keeper/safety monitor, reporter/recorder, facilitator, materials manager) * Time keeper/safety monitor keeps an eye on time and makes sure lab safety rules are being followed, materials manager retrieves/returns materials, recorder records data and reports final data to teacher immediately, facilitator assists and makes sure everyone participates) | | * Ensure every student is actively participating * Students can get feedback from teacher whether or not their data is consistent with other groups | **AfL**  Circulate around room |
| **Wrap-Up**  (15mins) | **Whole Class 🡪 Clean Up**   * Students to wash lab equipment and clean lab bench * Appoint auditor roles to responsible students (one student inventories all returned equipment, one student ensures benches are clean etc) * Students must clean up before working on lab handout | | * Students are made accountable for their actions |  |
| **Next Steps** | **Homework**   * Lab report due next week | | | |